CURRENT STATUS OF ARMY PROGRAM TO UPGRADE DEACTIVATION FURNACES TO MEET RCRA--LESSONS LEARNED

Jerry R. Miller
Chief APE Division
Directorate of Ammunition Equipment
Tooele Army Depot, Tooele, Utah 84074

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INTRODUCTION

In the United States, there are the twelve furnace sites which have been upgraded to meet RCRA requirements. There are currently four permitted furnace systems. Four other furnace systems are at different stages in the permitting process (See Figure 1). The reason for the reduction in the number of sites which are pursuing part B permits is because of funding constraints and directives imposed by HQIOC such as furnace workload both near term and long term.

With respect to the four permitted furnace sites, the first one, at Lake City Army Ammunition Plant, has been permitted and operating since 1990. The second, at Iowa Army Ammunition Plant, has been permitted for operation in 1994. The third, at Kansas Army Ammunition Plant, finished trial burn testing in late 1995 and is waiting for state approval to start production. The fourth, at Tooele Army Depot, was issued a RCRA Part B permit on 22 March 1993, modifications approved in December 1995, and production started in March 1996.

In regard to the remaining four sites actively seeking an operating permit, the first one, at McAlester Army Ammunition Plant, has a mini-burn test scheduled for early September 1996 with a trial burn test in October-November 1996. The second, at Hawthorne Army Depot has a mini-burn test scheduled for mid January 1997 with a trial burn test in April through May 1997. The third, at Sierra Army Depot, can burn small arms ammunition, 0.50 cal and less under a working agreement with the State of California. No trial burn test will be necessary because the TEAD trial burn test data was accepted. Sierra Army Depot anticipates receiving their Part B permit by December 1996. The fourth, at Blue Grass Army Depot (BGAD), has been independently seeking an operating permit.

Many lessons have been learned as these furnace systems have gone through the permitting processes, equipment has been operated, failures have occurred and operators have gained experience in operating the computer controlled systems. Some of these lessons and modifications made are discussed in the following paragraphs.

RCRA PERMITTING PROCESS

The permitting process as depicted in Figure 2, shows how much time the process has taken and reflects the time intervals which have consistently occurred as each site has pursued their permits.

Establishing trust and cooperation between State and Regional EPA personnel and environmental and operating site personnel is very important. The permitting process will generally move forward in a much more expeditious manner if this working relationship has been established. All parties need to be kept informed during the permitting process.

LESSONS LEARNED

TRIAL BURN TESTS

Based upon our experience in dealing with Trial Burn Tests (TBTs) at not only the TEAD furnace site but others such as at Lake City AAP, Iowa AAP and Kansas AAP, the following lessons have been learned:

a. Site personnel should utilize the 720 hour shake down period to make sure their equipment is running properly, that operator personnel are well trained and efficient in operating the equipment.

b. Mini-burn tests should be performed in advance of a TBT, to establish a coordinated, efficient plan for the TBT and resolve problems etc.

c. Plan ahead for the TBT and prepare in advance for feed stock, equipment, etc.

d. Request that State and Federal EPA agencies consider acceptance of Trial Burn Test data acquired at a tested facility be used in-lieu of doing a full blown trial burn test at a site trying to get a Part B permit.

e. Have USACHPPM perform a Tier III analysis for the site needing a Part B permit.

f. Be aware of the more stringent requirements that are being imposed on the sites seeking Part B permits such as HRAs, testing for dioxin and analogous furans, etc.

TEAD AMMO MISSION FURNACE MINI-BURN TESTS

Equipment problems plagued the TEAD Ammo Mission Furnace mini-burn tests. Lead and brass buildup in the discharge hopper and conveyor areas caused both stoppages and equipment damage. Loss of draft appeared to be a major problem also. Another problem area was the interfacing between the primary and secondary feed conveyor. The system did not operate properly for long enough periods of time to gather sufficient test data for proper system performance evaluation.

Transition pieces were placed between the primary and secondary feed conveyor to keep the ammunition items from jamming between these conveyors. This took care of most of the problems associated with these conveyors. For some munition feedstock, this transition area needs to be carefully reviewed and additional modifications might be needed.

Evaluation of the buildup of discharging molten lead and mixed metals led to the development of overlapping trays being added to the discharge conveyor system. Initially steel trays were designed, fabricated, field installed at the TEAD mission furnace. These trays were sprayed with baking oils to minimize sticking of the molten material leaving the discharge hopper

on the furnace. This worked pretty well, but it was determined that polished stainless steel trays would work much better. These trays still needed to be coated with a non sticking liquid. A heavy silicone spray is now used and seems to work best.

Loss of furnace draft appeared to be the major cause for the buildup of lead and brass in the discharge hopper and conveyor areas. When proper draft has been maintained, the buildup of these materials has been minimized.

SECOND TEAD AMMO MISSION FURNACE MINI-BURN TEST ATTEMPTS

In August 1994, an attempt was made to perform another Trial Burn Test so the munitions containing such constituents as Diphenylamine (DPA) and Hexachlorobenzine (HCB) could be incinerated under the established Part B permit. Most small arms ammunition fall into this category. The three 3-hour test runs feeding the 50 Cal. M48A1 rounds combined with chemicals and HCB could not be completed. The high temperature gas cooler became plugged with particulate. The plugging of the cooler block as well as corrosion caused the TBTs to be stopped.

Pictures of the particulate plugging of two damaged high temperature gas coolers are given in Figures 3 and 4. A side view of one of the plugged high temperature gas coolers is shown in Figure 5. Cooling air flows through the plates and spacing observable in the picture. Figures 6 and 7 show the buildup of particulate on the walls of the ducting ahead of the coolers.

An extensive investigation followed the aborted TBT to try and resolve the gas cooler problems. The cooler block manufacturer was approached to assist in resolution of the corrosion problems. Particulate removed from the cooler was analyzed. The main constituents were barium, lead oxide and sulfate compounds.

Both plugging and warpage of the plates in hot side of the high temperature cooler block caused major loss of the furnace draft. Warpage of the plates was addressed by rerouting the cooling air through the high temperature gas cooler block. Originally the cooling air made one pass through both the hot (input) and cool (output) cooler block sections. The change routed all of the cooling air first through the hot side and then through the cool side. This change more effectively cooled the plates, thus minimizing warpage of the plates due to overheating.

EVALUATION TESTS, EQUIPMENT RELOCATION AND MODIFICATIONS

Proposed changes were presented to the State of Utah and evaluation tests performed to demonstrate the effectiveness of these changes. The changes were to move the cyclone from its original position, to a location between the furnace kiln and the afterburner and to add an expansion chamber with impingement vanes ahead of the high temperature gas cooler.

The evaluation tests, performed at the AED Test Furnace utilizing Neutralite, a baghouse coating material, were completed during Oct and Nov 94. Based on the tests conducted,

repositioning of the cyclone between the furnace and the afterburner showed an advantage of removing most inorganics before they enter the afterburner and become molten causing premature damage and failure of the high temperature gas cooler (HTC) block. The addition of an expansion chamber, just ahead of the HTC, removed additional particulate from the flue gas stream and contributed to cooling the flue gas stream and solidification of the lead oxide prior to entering the HTC.

The moving and installation of equipment at the TEAD Ammo mission furnace was completed in Feb 95. The cyclone was repositioned between the furnace and the afterburner. An AED designed expansion chamber was fabricated and installed just ahead of the high temperature gas cooler. A double tipping valve was installed as part of the expansion chamber. New ducting was fabricated and installed. Thermocouples have been installed at the afterburner and into the new ducting where needed. Conduit was installed and electrical wiring was completed. See Figures 8 & 9 for pictures showing the repositioned and added equipment.

Clean out ports were added in the plenums above each section of the high and low temperature gas cooler blocks to allow for periodically checking the buildup of particulate on the edge of the plates. Through these ports mechanical cleaning/knocking loose of the particulate buildup could be performed. Also recommended, was to add inspection ports at strategic places in the ductwork to check on any buildup of residue on the inside of the ducting. The changes and modifications made at the TEAD Ammo Mission Furnace were provided, upon request, to all of the other furnace sites to assist them in improving their furnace system operations and obtaining their Part B operating permit.

HIGH TEMPERATURE COOLER REDESIGN

Due to the problems of plugging of both the high and low temperature gas coolers, AED personnel looked at designing the hot side of the low temperature cooler block. Salvaging of the damaged high temperature gas cooler (HTC) blocks from the TEAD Ammo Mission Furnace was performed. In concurrence with the TEAD Environmental Office and others, good sections were saved and the others were gutted of the damaged cooling plates. A different design for the internal sections was completed. One of the salvaged cooler block frames was used for incorporating the fabricated internal sections.

The AED designed low temperature cooler block was installed on the TEAD Ammo Furnace Testing and evaluation of the performance of the block was conducted. It has continued to perform satisfactorily.

HIGH TEMPERATURE CERAMIC BAGHOUSES

AED personnel are currently reviewing and evaluating candidate high temperature ceramic bags and baghouses which will eliminate the need for one, if not both, of the gas coolers in the current APE 1236M1 furnace configuration. It appears that both the high and low temperature gas coolers can be eliminated. In place of the coolers, high temperature ducting

from the afterburner to a new high temperature draft fan would be installed. A new high temperature baghouse with ceramic bags would receive the flue gases from the afterburner. The original baghouse would receive the exhaust gases from the high temperature baghouse providing extra filter protection. It appears that this system would cost less than the high temperature gas cooler system. Approval from HQIOC to pursue purchasing, testing and evaluating this system will need to be granted as well as Part B Permit modifications will need to be obtained.

Promising results have been obtained from a high temperature baghouse currently under development and testing in the United Kingdom by the Defense Test and Evaluation Organization (DTEO). A joint venture between Headquarters Industrial Operations Command (HQIOC), Ammunition Equipment Directorate (AED), and DTEO is being pursued. If HQIOC is successful in obtaining funding for this venture, then the APE 1236M1 deactivation furnace system, minus the high and low temperature gas coolers, with a high temperature baghouse will be packaged together into a unified system. Currently this unified system is planned for installation at Kadena Air Base, Okinawa, Japan.

CONCLUSIONS

Hopefully, the lessons learned, as presented in this paper, can be incorporated by the furnace sites in establishing efficient operating furnace systems, maintaining or obtaining Part B permits and in meeting the requirements of RCRA.

Success in utilizing newer technologies (high temperature baghouse, high temperature draft fan, etc.) will also open doors to broader use of the APE 12361M1 deactivation furnace for other applications and use throughout the world. There are also applications that should the current furnace package be made portable, it could be used for shipment to locations where on-site cleanup of hazardous waste is needed.

FIGURES

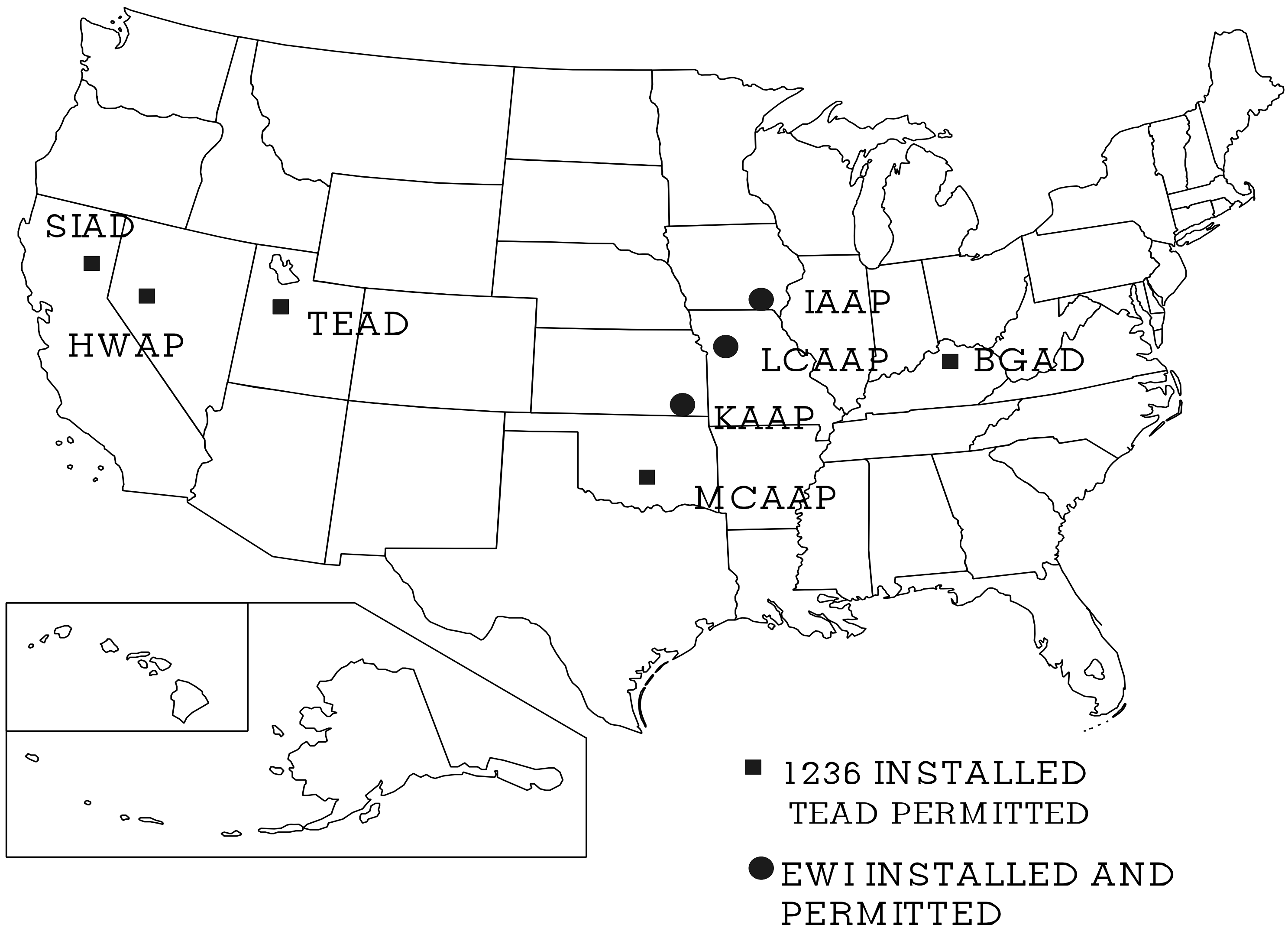

FIGURE 1: APE 1236 DEACTIVATION FURNACE UPGRADE SITES

FIGURE 2: RCRA PERMITTING PROCESS

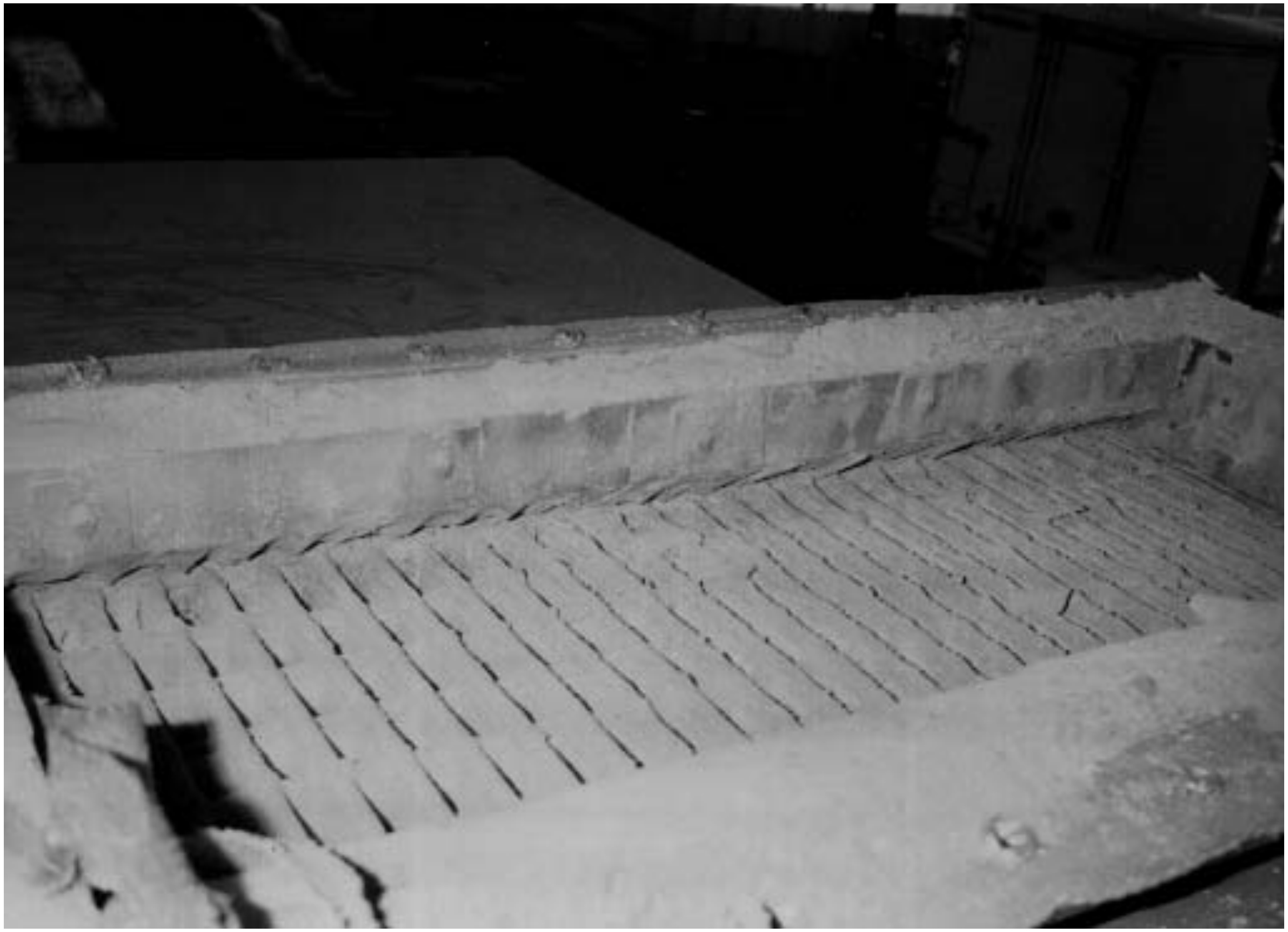

FIGURE 3: TOP VIEW OF CLOGGED
HIGH TEMPERATURE GAS COOLER

FIGURE 4: TOP VIEW OF ANOTHER CLOGGED
HIGH TEMPERATURE GAS COOLER

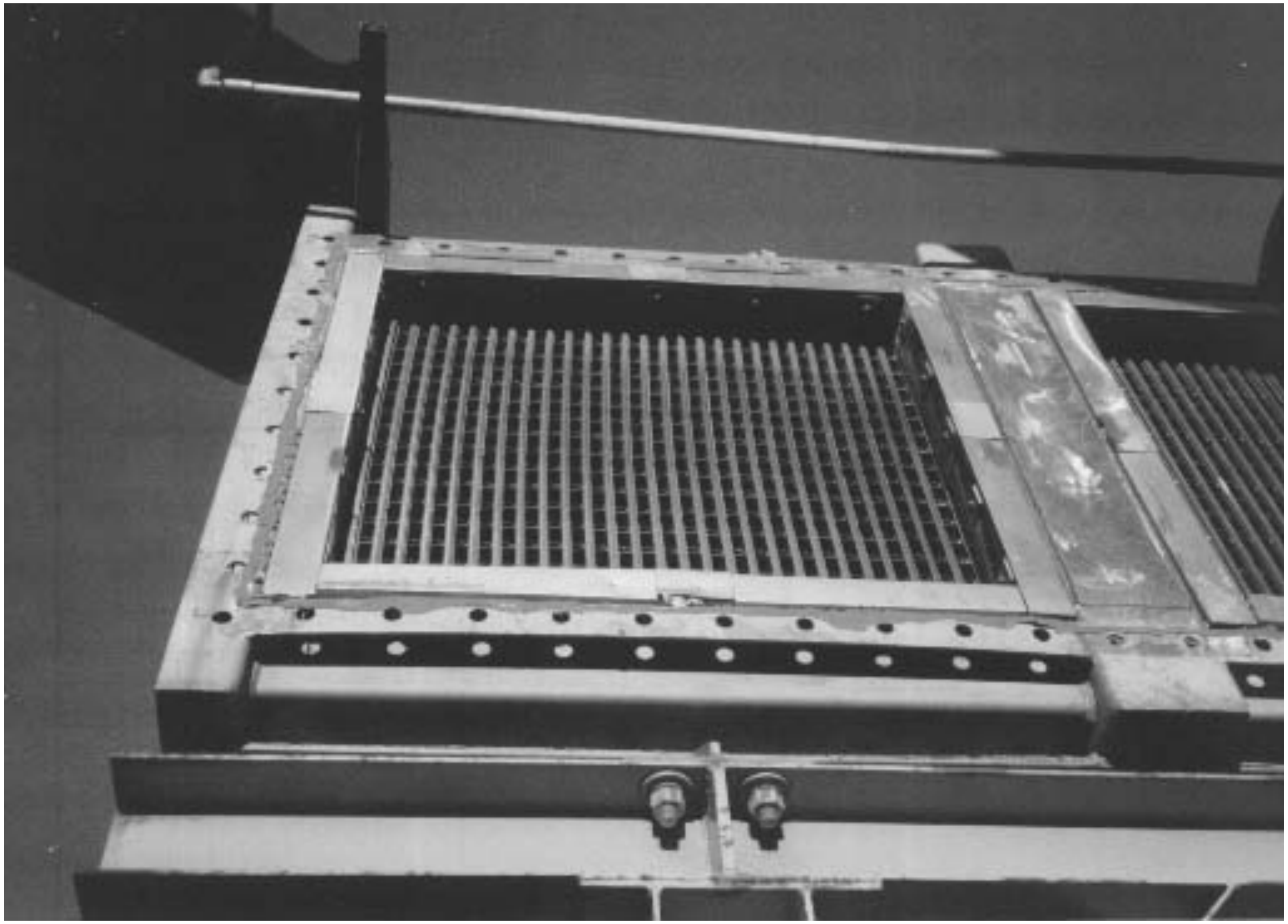

FIGURE 5: SIDE VIEW OF PLUGGED HIGH TEMPERATURE GAS COOLER SHOWING DISTORTED /WARPED PLATES

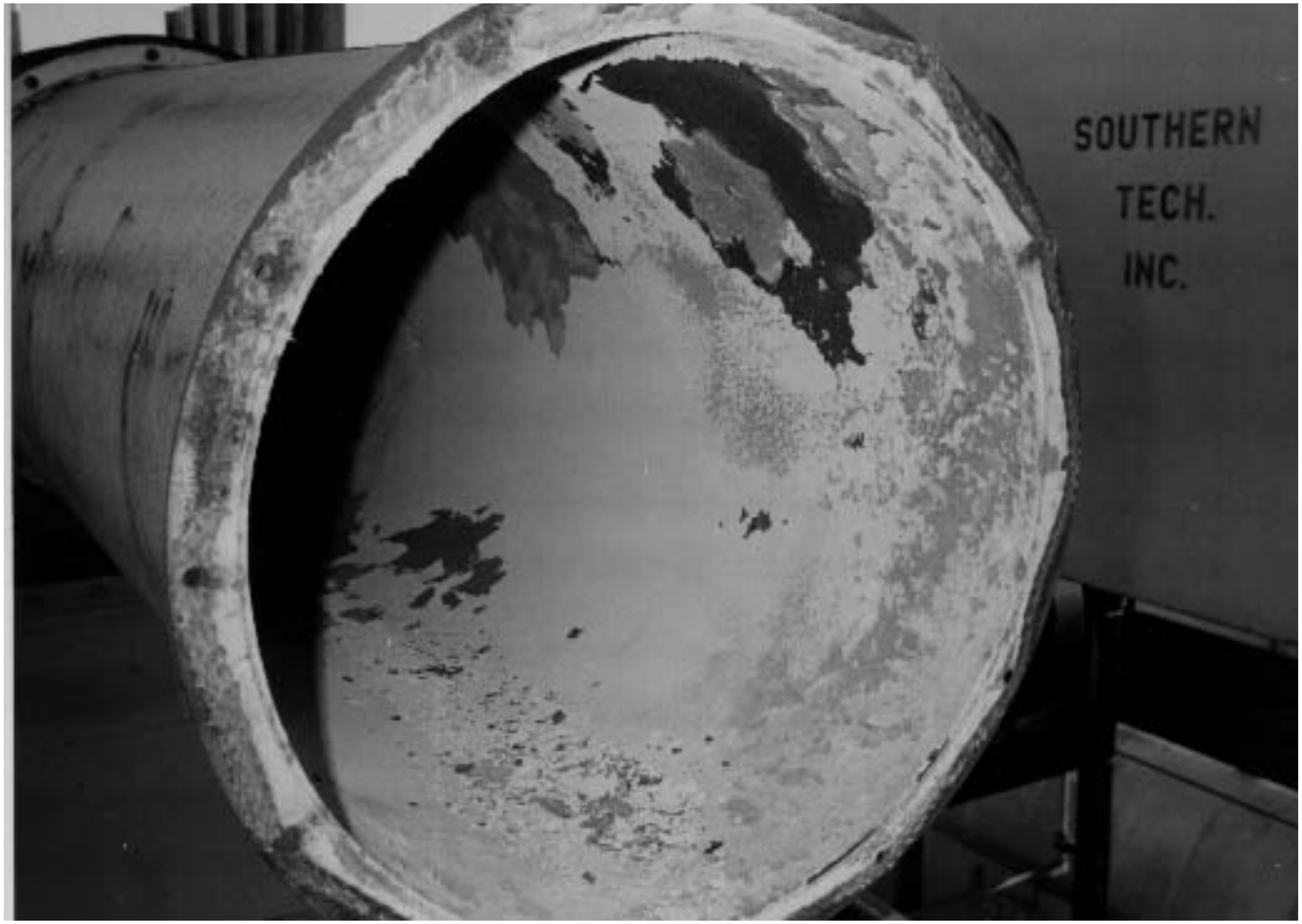

FIGURE 6: PARTICULATE COATING IN FURNACE DUCTING
AHEAD OF HIGH TEMPERATURE GAS COOLER

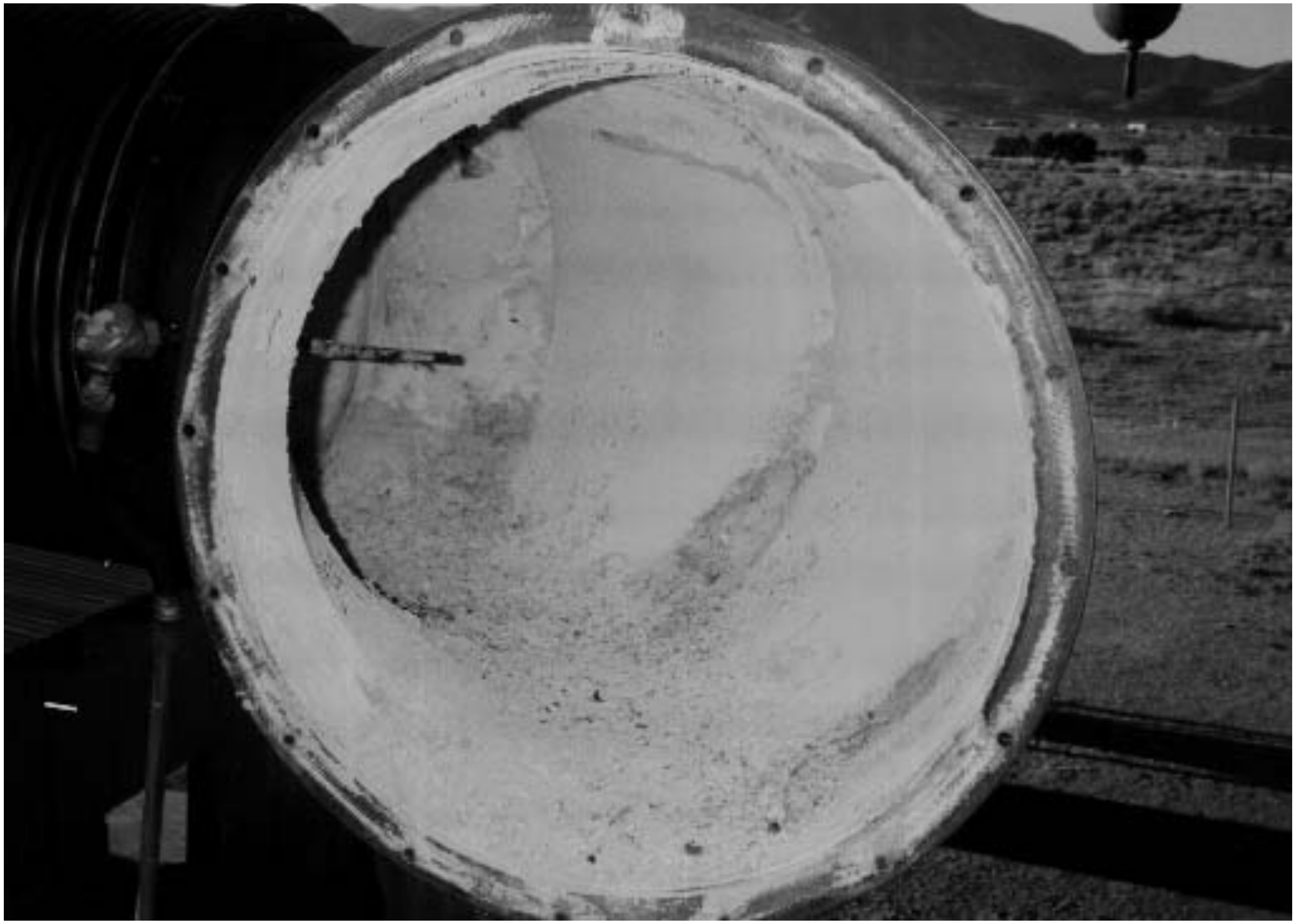

FIGURE 7: PARTICULATE COATING IN ANOTHER SECTION OF DUCTING AHEAD OF HIGH TEMPERATURE GAS COOLER

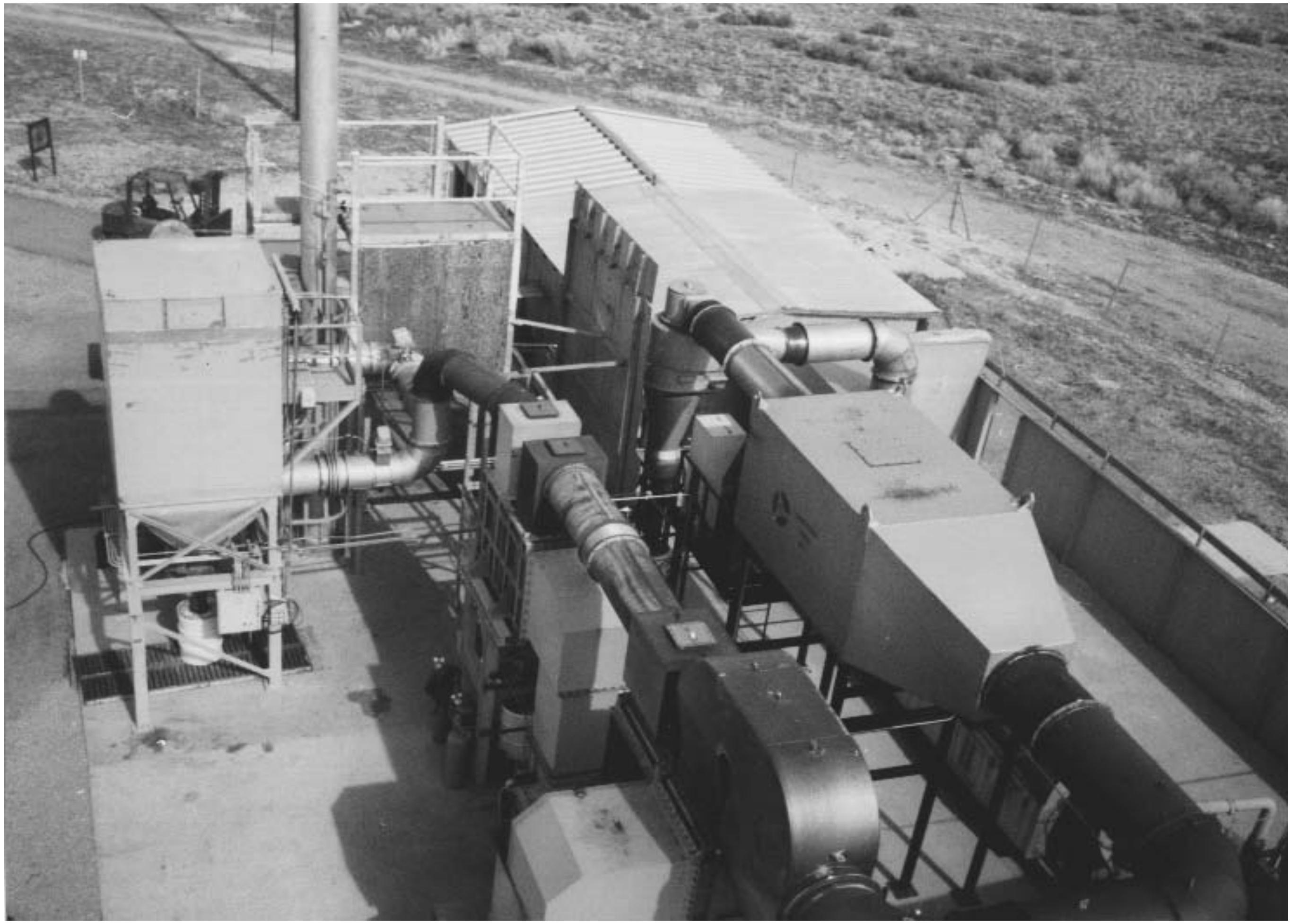

FIGURE 8: OVERVIEW OF DEACTIVATION FURNACE SYSTEM

FIGURE 9: VIEW OF DEACTIVATION FURNACE SYSTEM
(EXPANSION CHAMBER AND HIGH TEMPERATURE GAS COOLER IN FOREGROUND)